

FORM PTO-1-40 (Modified)
(REV 10-95)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

200719US3PCT

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/719538

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371INTERNATIONAL APPLICATION NO.
PCT/JP00/02318INTERNATIONAL FILING DATE
10 April 2000PRIORITY DATE CLAIMED
16 April 1999

TITLE OF INVENTION

AIR MIXING DAMPER APPARATUS AND AIR CONDITIONING APPARATUS FOR VEHICLES

APPLICANT(S) FOR DO/EO/US

Yoshihiro HASHIZUME, et al.

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

- This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
- This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
- This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
- A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
- A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - is transmitted herewith (required only if not transmitted by the International Bureau).
 - has been transmitted by the International Bureau.
 - is not required, as the application was filed in the United States Receiving Office (RO/US).
- A translation of the International Application into English (35 U.S.C. 371(c)(2)).
- A copy of the International Search Report (PCT/ISA/210).
- Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - are transmitted herewith (required only if not transmitted by the International Bureau).
 - have been transmitted by the International Bureau.
 - have not been made; however, the time limit for making such amendments has NOT expired.
 - have not been made and will not be made.
- A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
- An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
- A copy of the International Preliminary Examination Report (PCT/IPEA/409).
- A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 18 below concern document(s) or information included:

- An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
- An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
- A **FIRST** preliminary amendment.
- A **SECOND** or **SUBSEQUENT** preliminary amendment.
- A substitute specification.
- A change of power of attorney and/or address letter.
- Certificate of Mailing by Express Mail
- Other items or information:

Request for Consideration of Documents Cited in International Search Report

Notice of Priority

PCT/IB/304

PCT/IB/308

Drawings (16 sheets)

U.S. APPLICATION NO. (IF KNOWN) SEE PCT/PTO 097719538		INTERNATIONAL APPLICATION NO. PCT/JP00/02318	ATTORNEY'S DOCKET NUMBER 200719US3PCT
20. The following fees are submitted:		CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) : <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Search Report has been prepared by the EPO or JPO \$860.00 <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) \$690.00 <input type="checkbox"/> No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$710.00 <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO \$1000.00 <input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$100.00 			
ENTER APPROPRIATE BASIC FEE AMOUNT =		\$860.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)).		☒ 20	☐ 30
		\$130.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	19 - 20 =	0	x \$18.00 \$0.00
Independent claims	3 - 3 =	0	x \$80.00 \$0.00
Multiple Dependent Claims (check if applicable).		☐	\$0.00
TOTAL OF ABOVE CALCULATIONS =		\$990.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable).		☐	\$0.00
		☒	\$0.00
SUBTOTAL =		\$990.00	
Processing fee of \$130.00 for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)).		☐ 20	☐ 30 +
		\$0.00	
TOTAL NATIONAL FEE =		\$990.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).		☐	\$0.00
TOTAL FEES ENCLOSED =		\$990.00	
		Amount to be: refunded \$ charged \$	
<input checked="" type="checkbox"/> A check in the amount of \$990.00 to cover the above fees is enclosed.			
<input type="checkbox"/> Please charge my Deposit Account No. 15-0030 in the amount of to cover the above fees. A duplicate copy of this sheet is enclosed.			
<input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. 15-0030 A duplicate copy of this sheet is enclosed.			
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.			
SEND ALL CORRESPONDENCE TO:			
 22850		 C. Irvin McClelland NAME _____ 21,124 REGISTRATION NUMBER _____ Surinder Sachar Registration No. 34,423 DATE Dec. 18 2000	

09/719538
USPTO 18 DEC 2000

200719US

IN THE UNITED STATES PATENT & TRADEMARK OFFICE

- IN RE APPLICATION OF :
YOSHIHIRO HASHIZUME ET AL : ATTN: APPLICATION DIVISION
SERIAL NO: NEW APPLICATION :
(Based on PCT/JP00/02318)
FILED: HEREWITH :
FOR: AIR MIXING DAMPER APPARATUS:
AND AIR CONDITIONING
APPARATUS FOR VEHICLES

PRELIMINARY AMENDMENT

ASSISTANT COMMISSIONER FOR PATENTS
WASHINGTON, D.C. 20231

SIR:

Prior to a first examination on the merits, please amend the above-identified application as follows:

IN THE SPECIFICATION

Page 1, line 1, change "DESCRIPTION" to --TITLE OF THE INVENTION--;
prenumbered line 6, change "TECHNICAL FIELD" to
--Field of the Invention--;
prenumbered line 15, change "BACKGROUND ART" to
--Discussion of the Background--.
Page 4, prenumbered line 14, change "DISCLOSURE OF THE INVENTION" to
--SUMMARY OF THE INVENTION--.

Page 9, last line, change "BRIEF DESCRIPTION OF DRAWINGS" to

--BRIEF DESCRIPTION OF THE DRAWINGS--.

Page 11, prenumbered line 24, change "BEST MODE FOR CARRYING OUT THE INVENTION" to

--DISCUSSION OF THE PREFERRED EMBODIMENTS--.

IN THE CLAIMS

Please cancel Claims 1-11 without prejudice.

Please add new Claims 12-30 as follows:

--12. (New) An air mixing damper apparatus characterized in that there is provided between a plate door type air mixing damper for opening and closing an air introducing face of a heater core, and a rotation type lever of an actuator for driving the air mixing damper, a mechanism for adjusting rotational speed of the air mixing damper to linearly change the temperature of discharged air with respect to the operation of the lever of the actuator.

13. (New) An air mixing damper apparatus characterized in that there is provided between a plate door type air mixing damper for opening and closing an air introducing face of a heater core, and a rotation type lever of an actuator for driving the air mixing damper, a mechanism for adjusting rotational speed at an initial opening stage and a final opening stage of the air mixing damper, to a speed lower than at an intermediate opening stage.

14. (New) An air mixing damper apparatus according to claim 12, characterized in that said mechanism for adjusting rotational speed comprises; a cam provided in the air mixing damper and a pin provided on the lever of the actuator for engaging with said cam.

15. (New) An air mixing damper apparatus according to claim 13, characterized in that said mechanism for adjusting rotational speed comprises; a cam provided in the air mixing damper and a pin provided on the lever of the actuator for engaging with said cam.

16. (New) An air mixing damper apparatus according to claim 14, characterized in that said cam incorporates a guide path for guiding the pin of the lever of the actuator, and the guide path has a first guide path for effecting control at an initial opening stage of the air mixing damper, a second guide path for effecting control at an intermediate opening stage of the air mixing damper, and a third guide path for effecting control at a final opening stage of the air mixing damper.

17. (New) An air mixing damper apparatus according to claim 15, characterized in that said cam incorporates a guide path for guiding the pin of the lever of the actuator, and the guide path has a first guide path for effecting control at an initial opening stage of the air mixing damper, a second guide path for effecting control at an intermediate opening stage of the air mixing damper, and a third guide path for effecting control at a final opening stage of the air mixing damper.

18. (New) An air mixing damper apparatus according to claim 14, characterized in that said cam has an opening portion with a guide path for guiding the pin of the lever of the actuator provided around the periphery thereof, and the guide path has a first guide path for effecting control at an initial opening stage of the air mixing damper, a second guide path for effecting control at an intermediate opening stage of the air mixing damper, and a third guide path for effecting control at a final opening stage of the air mixing damper.

19. (New) An air mixing damper apparatus according to claim 15, characterized in that said cam has an opening portion with a guide path for guiding the pin of the lever of the actuator provided around the periphery thereof, and the guide path has a first guide path for

effecting control at an initial opening stage of the air mixing damper, a second guide path for effecting control at an intermediate opening stage of the air mixing damper, and a third guide path for effecting control at a final opening stage of the air mixing damper.

20. (New) An air mixing damper apparatus according to claim 16, characterized in that said first guide path is formed in a direction gradually separating outward with respect to a turning path of the pin of the lever of the actuator, in a fully closed position of the air mixing damper, and said third guide path is formed in a direction gradually separating outward with respect to the turning path of the pin of the lever of the actuator, in a fully open position of the air mixing damper.

21. (New) An air mixing damper apparatus according to claim 17, characterized in that said first guide path is formed in a direction gradually separating outward with respect to a turning path of the pin of the lever of the actuator, in a fully closed position of the air mixing damper, and said third guide path is formed in a direction gradually separating outward with respect to the turning path of the pin of the lever of the actuator, in a fully open position of the air mixing damper.

22. (New) An air mixing damper apparatus according to claim 18, characterized in that said first guide path is formed in a direction gradually separating outward with respect to a turning path of the pin of the lever of the actuator, in a fully closed position of the air mixing damper, and said third guide path is formed in a direction gradually separating outward with respect to the turning path of the pin of the lever of the actuator, in a fully open position of the air mixing damper.

23. (New) An air mixing damper apparatus according to claim 19, characterized in that said first guide path is formed in a direction gradually separating outward with respect to a turning path of the pin of the lever of the actuator, in a fully closed position of the air

mixing damper, and said third guide path is formed in a direction gradually separating outward with respect to the turning path of the pin of the lever of the actuator, in a fully open position of the air mixing damper.

24. (New) An air mixing damper apparatus according to claim 18, characterized in that there is provided urging means for urging the pin of the lever of the actuator into the first guide path at least at an initial opening stage of the air mixing damper, and urging the pin of the lever of the actuator into the third guide path at least at a final opening stage of the air mixing damper.

25. (New) An air mixing damper apparatus according to claim 19, characterized in that there is provided urging means for urging the pin of the lever of the actuator into the first guide path at least at an initial opening stage of the air mixing damper, and urging the pin of the lever of the actuator into the third guide path at least at a final opening stage of the air mixing damper.

26. (New) An air mixing damper apparatus according to claim 13, characterized in that the range of the opening of the air mixing damper is from fully closed to around 15 degrees in said initial opening stage shows, while the range of the opening of the air mixing damper is from 20 degrees from fully open to fully open in the final opening stage.

27. (New) An air conditioning apparatus for vehicles having an air conditioning unit provided with:

an inside air/outside air box incorporating an inside/outside air switching damper for opening an outside air introducing inlet and an inside air introducing inlet to selectively switch introduced air to one of inside air and outside air,

a blower unit having a blower fan for blowing the introduced air,

350 450 550 650

 a cooler unit fitted with an evaporator for exchanging heat between a refrigerant and
 said introduced air passing therethrough, and

 a heater unit having a heater core provided inside a heater unit case for heating the
 introduced air passing therein, an air mixing damper apparatus for adjusting the flow quantity
 of said introduced air which passes through said heater core, and a plurality of air outlets
 opening from said heater unit case and respectively provided with dampers, characterized in
 that said air mixing damper apparatus is an air mixing damper apparatus according to claim
12.

28. (New) An air conditioning apparatus for vehicles having an air conditioning unit
provided with:

 an inside air/outside air box incorporating an inside/outside air switching damper for
 opening an outside air introducing inlet and an inside air introducing inlet to selectively
 switch introduced air to one of inside air and outside air,

 a blower unit having a blower fan for blowing the introduced air,
 a cooler unit fitted with an evaporator for exchanging heat between a refrigerant and
 said introduced air passing therethrough, and

 a heater unit having a heater core provided inside a heater unit case for heating the
 introduced air passing therein, an air mixing damper apparatus for adjusting the flow quantity
 of said introduced air which passes through said heater core, and a plurality of air outlets
 opening from said heater unit case and respectively provided with dampers, characterized in
 that said air mixing damper apparatus is an air mixing damper apparatus according to claim
13.

29. (New) An air mixing damper apparatus provided with a plate door type air
mixing damper for opening and closing an air introducing face of a heater core, and operating

means for specifying an operating amount of the air mixing damper, characterized in that an operating amount of said air mixing damper with respect to an operating amount of said operating means changes from operation initiation to operation completion.

30. (New) An air mixing damper apparatus according to claim 29, characterized in that an operating amount of said air mixing damper with respect to an operating amount of said operating means at operation initiation and operation completion is small compared to at an intermediate operation stage.--

REMARKS

Favorable consideration of this application, as presently amended, is respectfully requested.

The present preliminary amendment is submitted to place the above-identified application in more proper format under United States practice. By the present preliminary amendment the specification has been amended to include suggested headings. Original claims 1-11 have been cancelled and new claims 12-30 have been presented for examination. New claims 12-30 are similar in scope to original claims 1-11 but have been written to no longer recite any reference numerals or multiple dependencies.

The present application is believed to be in condition for a full and thorough examination on the merits. An early and favorable consideration of the present application is hereby respectfully requested.

Respectfully submitted,

OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



Gregory J. Maier
Attorney of Record
Registration No. 25,599
Surinder Sachar
Registration No. 34,423



22850

(703) 413-3000
Fax No.: (703) 413-2220
SNS\la
I:\atty\SNS\200719-pr.wpd

DESCRIPTION

AIR MIXING DAMPER APPARATUS AND AIR CONDITIONING APPARATUS FOR
VEHICLES

5

TECHNICAL FIELD

This invention relates to an air mixing damper apparatus and an air conditioning apparatus for vehicles, and in particular, relates to an air mixing damper apparatus and an air conditioning apparatus for vehicles which can linearly alter the temperature of the discharged air by operation of a lever of an actuator driving an air mixing damper.

BACKGROUND ART

As is well known, an air conditioning apparatus for vehicles incorporates an inside air/outside air box comprising an inside/outside air switching damper that selectively switches introduced air to either inside air or outside air, a blower unit having a blower fan for circulating the introduced air, a cooler unit incorporating an evaporator for exchanging heat between a refrigerant and the introduced air passing therethrough, and an air conditioning unit having a heater unit.

The heater unit generally has a heater core inside a heater unit case for heating the introduced air passing

therethrough, an air mixing damper apparatus for regulating the flow volume of the introduced air passing through the heater core, and a plurality of air outlets opening from the heater unit case and respectively provided with dampers.

With the air mixing damper apparatus, a plate door type air mixing damper for opening and closing an air introducing face of the heater core is connected by a link to a rotation type lever of an actuator for driving the air mixing damper. When an occupant operates a lever or the like used for setting the temperature, on the control panel provided within the vehicle compartment, the actuator is driven and the actuator lever rotates and by way of the link, starts the operation of the air mixing damper. The opening of the air mixing damper adjusts the amount of introduced air passing through the heater core and also adjusts the temperature of the discharged air.

That is to say, in the fully closed position with the air intake face of the heater core closed off, cold air from an evaporator located upstream thereof is supplied in its unchanged state as discharged air, and with an increase in opening of the air mixing damper the amount of air to be introduced passing through the heater core increases so that the temperature of the discharged air rises. When the air mixing damper is in a fully opened position, for example all of the cold air from the evaporator is passed through the heater core so that the temperature of the discharged air is increased.

However, in the case of the aforementioned conventional air mixing damper apparatus, at the time when the air mixing damper starts to open and at the time when the opening is completed, that is, during the interval that the air mixing damper is opened from a fully closed to a slightly opened position, and during the interval from a little before the fully open position through to a fully opened position, there is a problem that, compared to other positions, the temperature changes at these times is severe. That is to say, looking at FIG. 17 showing the relationship between the opening of the air mixing damper and the temperature of the discharged air, the change in temperature corresponding to movement of the actuator lever is extremely sharp at the initial opening stage where the opening of the air mixing damper is slight, and at the final opening stage where the air mixing damper is at a little before the fully open position through to the fully opened position.

This kind of phenomenon is a problem which generally arises in cases where the air mixing damper is linearly rotated together with an actuator lever. To explain simply, this is because at the time when the air mixing damper starts opening and when opening is completed it responds sensitively, and at other times when it is opened midway the response is slow.

Accordingly, if in this way it is not possible to obtain a linear change in the temperature of the discharged air with respect to the operation of an actuator lever, that is, with

respect to operation by an occupant, instances arise in which it is not possible to achieve air conditioning as intended by the occupant.

For the purpose of counteracting this, it has been
5 considered to drive the actuator so that it rotates slowly at times when the air mixing damper is starting to open and when it completes opening. However there is a problem in that such an improvement to the actuator is accompanied by higher costs.

Further, the provision of a baffle has also been
10 considered in order to effect an appropriate change in temperature. However, there is a problem in that a decrease in air volume as a result of a baffle is unavoidable.

DISCLOSURE OF THE INVENTION

Accordingly the present invention provides an air mixing damper apparatus and an air conditioning apparatus for vehicles where the temperature of the discharged air can be changed linearly with respect to the operation of an actuator
20 lever.

In order to resolve the abovementioned problems, a first aspect of the present invention is an air mixing damper apparatus characterized in that there is provided between a plate door type air mixing damper for opening and closing an
25 air introducing face of a heater core, and a rotation type lever of an actuator for driving the air mixing damper, a mechanism for adjusting rotational speed of the air mixing

damper to linearly change the temperature of discharged air with respect to the operation of the lever of the actuator. With such a construction, it becomes possible to linearly change the temperature of the discharged air with respect to 5 the operation of the actuator lever.

A second aspect of the present invention is an air mixing damper apparatus characterized in that there is provided between a plate door type air mixing damper for opening and closing an air introducing face of a heater core, and a 10 rotation type lever of an actuator for driving the air mixing damper, a mechanism for adjusting rotational speed at an initial opening stage and a final opening stage of the air mixing damper, to a speed lower than at an intermediate opening stage. With such a construction, it becomes possible 15 to lower the change amount with respect to the movement of the actuator lever at the initial opening stage and the final opening stage of the air mixing damper, to a less than at the intermediate opening stage.

With a third aspect of the present invention, an air 20 mixing damper apparatus of the first or second aspects is characterized in that the mechanism for adjusting rotational speed comprises; a cam provided in the air mixing damper and a pin provided on the lever of the actuator for engaging with the cam. With such a construction, there is no longer a need 25 to improve the actuator.

With a fourth aspect of the present invention, the air mixing damper apparatus of the third aspect is characterized

in that the cam incorporates a guide path for guiding the pin of the lever of the actuator, and the guide path has a first guide path for effecting control at an initial opening stage of the air mixing damper, a second guide path for effecting control at an intermediate opening stage of the air mixing damper, and a third guide path for effecting control at a final opening stage of the air mixing damper. With such a construction, it becomes possible to form a first guide path, a second guide path and a third guide path, in accordance with the air mixing damper.

10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
105
110
115
120
125
130
135
140
145
150
155
160
165
170
175
180
185
190
195
200
205
210
215
220
225
230
235
240
245
250
255
260
265
270
275
280
285
290
295
300
305
310
315
320
325
330
335
340
345
350
355
360
365
370
375
380
385
390
395
400
405
410
415
420
425
430
435
440
445
450
455
460
465
470
475
480
485
490
495
500
505
510
515
520
525
530
535
540
545
550
555
560
565
570
575
580
585
590
595
600
605
610
615
620
625
630
635
640
645
650
655
660
665
670
675
680
685
690
695
700
705
710
715
720
725
730
735
740
745
750
755
760
765
770
775
780
785
790
795
800
805
810
815
820
825
830
835
840
845
850
855
860
865
870
875
880
885
890
895
900
905
910
915
920
925
930
935
940
945
950
955
960
965
970
975
980
985
990
995
1000
1005
1010
1015
1020
1025
1030
1035
1040
1045
1050
1055
1060
1065
1070
1075
1080
1085
1090
1095
1100
1105
1110
1115
1120
1125
1130
1135
1140
1145
1150
1155
1160
1165
1170
1175
1180
1185
1190
1195
1200
1205
1210
1215
1220
1225
1230
1235
1240
1245
1250
1255
1260
1265
1270
1275
1280
1285
1290
1295
1300
1305
1310
1315
1320
1325
1330
1335
1340
1345
1350
1355
1360
1365
1370
1375
1380
1385
1390
1395
1400
1405
1410
1415
1420
1425
1430
1435
1440
1445
1450
1455
1460
1465
1470
1475
1480
1485
1490
1495
1500
1505
1510
1515
1520
1525
1530
1535
1540
1545
1550
1555
1560
1565
1570
1575
1580
1585
1590
1595
1600
1605
1610
1615
1620
1625
1630
1635
1640
1645
1650
1655
1660
1665
1670
1675
1680
1685
1690
1695
1700
1705
1710
1715
1720
1725
1730
1735
1740
1745
1750
1755
1760
1765
1770
1775
1780
1785
1790
1795
1800
1805
1810
1815
1820
1825
1830
1835
1840
1845
1850
1855
1860
1865
1870
1875
1880
1885
1890
1895
1900
1905
1910
1915
1920
1925
1930
1935
1940
1945
1950
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
2055
2060
2065
2070
2075
2080
2085
2090
2095
2100
2105
2110
2115
2120
2125
2130
2135
2140
2145
2150
2155
2160
2165
2170
2175
2180
2185
2190
2195
2200
2205
2210
2215
2220
2225
2230
2235
2240
2245
2250
2255
2260
2265
2270
2275
2280
2285
2290
2295
2300
2305
2310
2315
2320
2325
2330
2335
2340
2345
2350
2355
2360
2365
2370
2375
2380
2385
2390
2395
2400
2405
2410
2415
2420
2425
2430
2435
2440
2445
2450
2455
2460
2465
2470
2475
2480
2485
2490
2495
2500
2505
2510
2515
2520
2525
2530
2535
2540
2545
2550
2555
2560
2565
2570
2575
2580
2585
2590
2595
2600
2605
2610
2615
2620
2625
2630
2635
2640
2645
2650
2655
2660
2665
2670
2675
2680
2685
2690
2695
2700
2705
2710
2715
2720
2725
2730
2735
2740
2745
2750
2755
2760
2765
2770
2775
2780
2785
2790
2795
2800
2805
2810
2815
2820
2825
2830
2835
2840
2845
2850
2855
2860
2865
2870
2875
2880
2885
2890
2895
2900
2905
2910
2915
2920
2925
2930
2935
2940
2945
2950
2955
2960
2965
2970
2975
2980
2985
2990
2995
3000
3005
3010
3015
3020
3025
3030
3035
3040
3045
3050
3055
3060
3065
3070
3075
3080
3085
3090
3095
3100
3105
3110
3115
3120
3125
3130
3135
3140
3145
3150
3155
3160
3165
3170
3175
3180
3185
3190
3195
3200
3205
3210
3215
3220
3225
3230
3235
3240
3245
3250
3255
3260
3265
3270
3275
3280
3285
3290
3295
3300
3305
3310
3315
3320
3325
3330
3335
3340
3345
3350
3355
3360
3365
3370
3375
3380
3385
3390
3395
3400
3405
3410
3415
3420
3425
3430
3435
3440
3445
3450
3455
3460
3465
3470
3475
3480
3485
3490
3495
3500
3505
3510
3515
3520
3525
3530
3535
3540
3545
3550
3555
3560
3565
3570
3575
3580
3585
3590
3595
3600
3605
3610
3615
3620
3625
3630
3635
3640
3645
3650
3655
3660
3665
3670
3675
3680
3685
3690
3695
3700
3705
3710
3715
3720
3725
3730
3735
3740
3745
3750
3755
3760
3765
3770
3775
3780
3785
3790
3795
3800
3805
3810
3815
3820
3825
3830
3835
3840
3845
3850
3855
3860
3865
3870
3875
3880
3885
3890
3895
3900
3905
3910
3915
3920
3925
3930
3935
3940
3945
3950
3955
3960
3965
3970
3975
3980
3985
3990
3995
4000
4005
4010
4015
4020
4025
4030
4035
4040
4045
4050
4055
4060
4065
4070
4075
4080
4085
4090
4095
4100
4105
4110
4115
4120
4125
4130
4135
4140
4145
4150
4155
4160
4165
4170
4175
4180
4185
4190
4195
4200
4205
4210
4215
4220
4225
4230
4235
4240
4245
4250
4255
4260
4265
4270
4275
4280
4285
4290
4295
4300
4305
4310
4315
4320
4325
4330
4335
4340
4345
4350
4355
4360
4365
4370
4375
4380
4385
4390
4395
4400
4405
4410
4415
4420
4425
4430
4435
4440
4445
4450
4455
4460
4465
4470
4475
4480
4485
4490
4495
4500
4505
4510
4515
4520
4525
4530
4535
4540
4545
4550
4555
4560
4565
4570
4575
4580
4585
4590
4595
4600
4605
4610
4615
4620
4625
4630
4635
4640
4645
4650
4655
4660
4665
4670
4675
4680
4685
4690
4695
4700
4705
4710
4715
4720
4725
4730
4735
4740
4745
4750
4755
4760
4765
4770
4775
4780
4785
4790
4795
4800
4805
4810
4815
4820
4825
4830
4835
4840
4845
4850
4855
4860
4865
4870
4875
4880
4885
4890
4895
4900
4905
4910
4915
4920
4925
4930
4935
4940
4945
4950
4955
4960
4965
4970
4975
4980
4985
4990
4995
5000
5005
5010
5015
5020
5025
5030
5035
5040
5045
5050
5055
5060
5065
5070
5075
5080
5085
5090
5095
5100
5105
5110
5115
5120
5125
5130
5135
5140
5145
5150
5155
5160
5165
5170
5175
5180
5185
5190
5195
5200
5205
5210
5215
5220
5225
5230
5235
5240
5245
5250
5255
5260
5265
5270
5275
5280
5285
5290
5295
5300
5305
5310
5315
5320
5325
5330
5335
5340
5345
5350
5355
5360
5365
5370
5375
5380
5385
5390
5395
5400
5405
5410
5415
5420
5425
5430
5435
5440
5445
5450
5455
5460
5465
5470
5475
5480
5485
5490
5495
5500
5505
5510
5515
5520
5525
5530
5535
5540
5545
5550
5555
5560
5565
5570
5575
5580
5585
5590
5595
5600
5605
5610
5615
5620
5625
5630
5635
5640
5645
5650
5655
5660
5665
5670
5675
5680
5685
5690
5695
5700
5705
5710
5715
5720
5725
5730
5735
5740
5745
5750
5755
5760
5765
5770
5775
5780
5785
5790
5795
5800
5805
5810
5815
5820
5825
5830
5835
5840
5845
5850
5855
5860
5865
5870
5875
5880
5885
5890
5895
5900
5905
5910
5915
5920
5925
5930
5935
5940
5945
5950
5955
5960
5965
5970
5975
5980
5985
5990
5995
6000
6005
6010
6015
6020
6025
6030
6035
6040
6045
6050
6055
6060
6065
6070
6075
6080
6085
6090
6095
6100
6105
6110
6115
6120
6125
6130
6135
6140
6145
6150
6155
6160
6165
6170
6175
6180
6185
6190
6195
6200
6205
6210
6215
6220
6225
6230
6235
6240
6245
6250
6255
6260
6265
6270
6275
6280
6285
6290
6295
6300
6305
6310
6315
6320
6325
6330
6335
6340
6345
6350
6355
6360
6365
6370
6375
6380
6385
6390
6395
6400
6405
6410
6415
6420
6425
6430
6435
6440
6445
6450
6455
6460
6465
6470
6475
6480
6485
6490
6495
6500
6505
6510
6515
6520
6525
6530
6535
6540
6545
6550
6555
6560
6565
6570
6575
6580
6585
6590
6595
6600
6605
6610
6615
6620
6625
6630
6635
6640
6645
6650
6655
6660
6665
6670
6675
6680
6685
6690
6695
6700
6705
6710
6715
6720
6725
6730
6735
6740
6745
6750
6755
6760
6765
6770
6775
6780
6785
6790
6795
6800
6805
6810
6815
6820
6825
6830
6835
6840
6845
6850
6855
6860
6865
6870
6875
6880
6885
6890
6895
6900
6905
6910
6915
6920
6925
6930
6935
6940
6945
6950
6955
6960
6965
6970
6975
6980
6985
6990
6995
7000
7005
7010
7015
7020
7025
7030
7035
7040
7045
7050
7055
7060
7065
7070
7075
7080
7085
7090
7095
7100
7105
7110
7115
7120
7125
7130
7135
7140
7145
7150
7155
7160
7165
7170
7175
7180
7185
7190
7195
7200
7205
7210
7215
7220
7225
7230
7235
7240
7245
7250
7255
7260
7265
7270
7275
7280
7285
7290
7295
7300
7305
7310
7315
7320
7325
7330
7335
7340
7345
7350
7355
7360
7365
7370
7375
7380
7385
7390
7395
7400
7405
7410
7415
7420
7425
7430
7435
7440
7445
7450
7455
7460
7465
7470
7475
7480
7485
7490
7495
7500
7505
7510
7515
7520
7525
7530
7535
7540
7545
7550
7555
7560
7565
7570
7575
7580
7585
7590
7595
7600
7605
7610
7615
7620
7625
7630
7635
7640
7645
7650
7655
7660
7665
7670
7675
7680
7685
7690
7695
7700
7705
7710
7715
7720
7725
7730
7735
7740
7745
7750
7755
7760
7765
7770
7775
7780
7785
7790
7795
7800
7805
7810
7815
7820
7825
7830
7835
7840
7845
7850
7855
7860
7865
7870
7875
7880
7885
7890
7895
7900
7905
7910
7915
7920
7925
7930
7935
7940
7945
7950
7955
7960
7965
7970
7975
7980
7985
7990
7995
8000
8005
8010
8015
8020
8025
8030
8035
8040
8045
8050
8055
8060
8065
8070
8075
8080
8085
8090
8095
8100
8105
8110
8115
8120
8125
8130
8135
8140
8145
8150
8155
8160
8165
8170
8175
8180
8185
8190
8195
8200
8205
8210
8215
8220
8225
8230
8235
8240
8245
8250
8255
8260
8265
8270
8275
8280
8285
8290
8295
8300
8305
8310
8315
8320
8325
8330
8335
8340
8345
8350
8355
8360
8365
8370
8375
8380
8385
8390
8395
8400
8405
8410
8415
8420
8425
8430
8435
8440
8445
8450
8455
8460
8465
8470
8475
8480
8485
8490
8495
8500
8505
8510
8515
8520
8525
8530
8535
8540
8545
8550
8555
8560
8565
8570
8575
8580
8585
8590
8595
8600
8605
8610
8615
8620
8625
8630
8635
8640
8645
8650
8655
8660
8665
8670
8675
8680
8685
8690
8695
8700
8705
8710
8715
8720
8725
8730
8735
8740
8745
8750
8755
8760
8765
8770
8775
8780
8785
8790
8795
8800
8805
8810
8815
8820
8825
8830
8835
8840
8845
8850
8855
8860
8865
8870
8875
8880
8885
8890
8895
8900
8905
8910
8915
8920
8925
8930
8935
8940
8945
8950
8955
8960
8965
8970
8975
8980
8985
8990
8995
9000
9005
9010
9015
9020
9025
9030
9035
9040
9045
9050
9055
9060
9065
9070
9075
9080
9085
9090
9095
9100
9105
9110
9115
9120
9125
9130
9135
9140
9145
9150
9155
9160
9165
9170
9175
9180
9185
9190
9195
9200
9205
9210
9215
9220
9225
9230
9235
9240
9245
9250
9255
9260
9265
9270
9275
9280
9285
9290
9295
9300
9305
9310
9315
9320
9325
9330
9335
9340
9345
9350
9355
9360
9365
9370
9375
9380
9385
9390
9395
9400
9405
9410
9415
9420
9425
9430
9435
9440
9445
9450
9455
9460
9465
9470
9475
9480
9485
9490
9495
9500
9505
9510
9515
9520
9525
9530
9535
9540
9545
9550
9555
9560
9565
9570
9575
9580
9585
9590
9595
9600
9605
9610
9615
9620
9625
9630
9635
9640
9645
9650
9655
9660
9665
9670
9675
9680
9685
9690
9695
9700
9705
9710
9715
9720
9725
9730
9735
9740
9745
9750
9755
9760
9765
9770
9775
9780
9785
9790
9795
9800
9805
9810
9815
9820
9825
9830
9835
9840
9845
9850
9855
9860
9865
9870
9875
9880
9885
9890
9895
9900
9905
9910
9915
9920
9925
9930
9935
9940
9945
9950
9955
9960
9965
9970
9975
9980
9985
9990
9995
10000
10005
10010
10015
10020
10025
10030
10035
10040
10045
10050
10055
10060
10065
10070
10075
10080
10085
10090
10095
10100
10105
10110
10115
10120
10125
10130
10135
10140
10145
10150
10155
10160
10165
10170
10175
10180
10185
10190
10195
10200
10205
10210
10215
10220
10225
10230
10235
10240
10245
10250
10255
10260
10265
10270
10275
10280
10285
1

turning path of the pin of the lever of the actuator, in a fully closed position of the air mixing damper, and the third guide path is formed in a direction gradually separating outward with respect to the turning path of the pin of the 5 lever of the actuator, in a fully open position of the air mixing damper. With such a construction, in the initial opening stage of the air mixing damper, when the air mixing damper starts to open from a fully closed position, it is possible to operate in such a way that it opens gradually.

Moreover, in the final opening stage of the air mixing damper, it is also possible to operate in such a way that it opens gradually during the interval between a near fully opened position and a fully opened position.

With a seventh aspect of the present invention, the air mixing damper apparatus of the fifth or the sixth aspects is characterized in that there is provided an urging device for urging the pin of the lever of the actuator into the first guide path at least at an initial opening stage of the air mixing damper, and urging the pin of the lever of the actuator 20 into the third guide path at least at a final opening stage of the air mixing damper. With such a construction, it becomes possible to positively guide the pin of the actuator lever in at least the first guide path and the third guide path.

With an eighth aspect of the present invention, the air 25 mixing damper apparatus of any one of the second through seventh aspects is characterized in that the range of the opening of the air mixing damper is from fully closed to

around 15 degrees in the initial opening stage, while the range of the opening of the air mixing damper is from 20 degrees from fully open to fully open in the final opening stage.

- 5 A ninth aspect of the present invention is an air conditioning apparatus for vehicles having an air conditioning unit provided with: an inside air/outside air box incorporating an inside/outside air switching damper for opening an outside air introducing inlet and an inside air introducing inlet to selectively switch introduced air to one of inside air and outside air, a blower unit having a blower fan for blowing the introduced air, a cooler unit fitted with an evaporator for exchanging heat between a refrigerant and the introduced air passing therethrough, and a heater unit having a heater core provided inside a heater unit case for heating the introduced air passing therein, an air mixing damper apparatus for adjusting the flow quantity of the introduced air which passes through the heater core, and a plurality of air outlets opening from the heater unit case and
- 10 respectively provided with dampers, characterized in that the air mixing damper apparatus is an air mixing damper apparatus according to any one of the first through eighth aspects. With such a construction, it becomes possible to linearly change the temperature of the discharged air in accordance
- 15 with the operation of temperature adjustment of the discharged air by an occupant.

A tenth aspect of the present invention is an air mixing damper apparatus provided with a plate door type air mixing damper for opening and closing an air introducing face of a heater core, and an operating device for specifying an
5 operating amount of the air mixing damper, characterized in that an operating amount of the air mixing damper with respect to an operating amount of the operating device changes from operation initiation to operation completion. With such a construction, it becomes possible to stabilize the change in
10 the temperature of the discharged air in accordance with the operation by an occupant of temperature adjustment of the discharged air.

10
15
20

With an eleventh aspect of the present invention, the air mixing damper apparatus of the tenth aspect is characterized in that an operating amount of the air mixing damper with respect to an operating amount of the operating device at operation initiation and operation completion is small compared to at an intermediate operation stage. With such a construction, it becomes possible to linearly change the
20 temperature of the discharged air in accordance with the operation by an occupant of temperature adjustment of the discharged air.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a diagram for explaining a fully closed position (lever rotation angle 0 degrees) of an air mixing damper of an embodiment of the present invention.

FIG. 2 is a graph showing a relationship between actuator lever rotation amount and opening of the air mixing damper of an embodiment of the present invention.

FIG. 3 is a graph showing the relationship between actuator lever rotation amount and discharged air temperature of an embodiment of the present invention.

FIG. 4 is a sectional view showing an air conditioning unit of one embodiment of the present invention.

FIG. 5 is a perspective view of an engine room of a vehicle installed with an air conditioning apparatus for vehicles.

FIG. 6 is a perspective view from inside the vehicle compartment of the vehicle installed with an air conditioning apparatus for vehicles.

FIG. 7 is a diagram for explaining an operational state of the air mixing damper (with the lever rotation angle at 10 degrees).

FIG. 8 is a diagram for explaining an operational state of the air mixing damper (with the lever rotation angle at 20 degrees).

FIG. 9 is a diagram for explaining an operational state of the air mixing damper (with the lever rotation angle at 30 degrees).

FIG. 10 is a diagram for explaining an operational state of the air mixing damper (with the lever rotation angle at 40 degrees).

FIG. 11 is a diagram for explaining an operational state 5 of the air mixing damper (with the lever rotation angle at 50 degrees).

FIG. 12 is a diagram for explaining an operational state of the air mixing damper (with the lever rotation angle at 60 degrees).

FIG. 13 is a diagram for explaining an operational state of the air mixing damper (with the lever rotation angle at 70 degrees).

FIG. 14 is a diagram for explaining an operational state of the air mixing damper (with the lever rotation angle at 80 degrees).

FIG. 15 is a diagram for explaining an operational state of the air mixing damper (with the lever rotation angle at 90 degrees).

FIG. 16 is a diagram for explaining an operational state 20 of the air mixing damper (with the lever rotation angle at 100 degrees).

FIG. 17 is a prior art graph corresponding to FIG. 3.

BEST MODE FOR CARRYING OUT THE INVENTION

Hereunder is a description of embodiments of the present invention in conjunction with the drawings. FIG. 4 through

FIG. 6 show the construction of an air conditioning apparatus for vehicles. This air conditioning apparatus for vehicles generally comprises: an air conditioning unit 1 for performing air conditioning such as cooling and the like, a 5 cooling system 2 for supplying refrigerant to the air conditioning unit 1 at the time of a cooling operation, a heating system 3 for supplying engine cooling water as a heat source to the air conditioning unit 1 at the time of a heating operation, and a control section 4 for controlling the 10 operation of the overall equipment.

10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100

The air conditioning unit 1, as shown in FIG. 4, comprises: an inside air/outside air box 10, a blower unit 20, a cooler unit 30 and a heater unit 40 either as a single unit, or connected together. As shown in FIG. 5 and FIG. 6, in the case of a typical passenger vehicle, the air conditioning unit 1 is installed widthwise on the passenger seat side, on the left side as seen from the vehicle interior, and positioned beneath the dashboard 5 behind the engine room 6. Hereunder is a description of the air conditioning unit 1 20 in air flow sequence.

The inside air/outside air box 10 is a part having a function of selectively switching the introduced air for the air conditioning unit 1 to either one of outside air (air outside the vehicle compartment) and inside air (air inside 25 the vehicle compartment). Here, an outside air introducing inlet 11a communicating with the vehicle exterior and an inside air introducing inlet 11b communicating with the

vehicle interior are provided. One of the two inlets 11a and 11b is closed by an inside/outside switching damper 12, to select the introduced air (hereafter referred to as introduced air).

5 The blower unit 20 is provided and connected downstream of the inside air/outside air box 10, and has the function of selectively drawing in outside air "a" or inside air "b" by operation of a blower fan 21, and of sending this to the cooler unit 30 (to be described later). The blower fan 21 has an electric motor 22 as the drive source, and in general, as well as a stop position, is able to be switched for several different air flow quantities. Here, in the case where outside air "a" is introduced while the vehicle is travelling, then even if the blower fan 21 is stopped, the outside air "a", which is moving relatively to the vehicle, can flow to the cooler unit 30. Moreover, depending on the air conditioning unit 1, there are also cases where the blower unit 20 is installed on the downstream side of the later described cooler unit 30.

20 The cooler unit 30 has the function of cooling and dehumidifying the introduced air sent from the blower unit 20. The cooler unit 30 comprises an evaporator 31 serving as a heat exchanger, and a cooler unit case 32 housing the evaporator 31.

25 The evaporator 31, at the time of cooling operation, receives a supply of low temperature low pressure liquid refrigerant from the cooling system 2 (to be described later),

and exchanges heat between the liquid refrigerant and the introduced air sent from the blower unit 20 and passing through the evaporator 31. As a result, the introduced air gives up heat to the refrigerant and becomes cooled and dehumidified cold air, and is then introduced to the heater unit 40.

The cooler unit case 32 is a resin molded product forming one part of the air conditioning duct AD constituting the flow path of the introduced air, with an upstream side end portion connected to the blower unit 20, and a downstream side end portion connected to the heater unit 40.

卷之三

The heater unit 40 has the function of selectively heating the introduced air which has been sent from the cooler unit 30, and of discharging the air conditioned air from the air outlets in accordance with the operation mode. The heater unit 40 comprises; a heater core 42 installed inside the heater unit case 40, an air mixing damper apparatus 43 (to be described later) for adjusting the flow quantity of introduced air passing through the heater core 42, and a defroster air outlet 44, a face air outlet 45 and a foot air outlet 46, which open from the heater unit case 41 and which are respectively provided with an open/closable defroster damper 44a, face damper 45a, and foot damper 46a.

The heater core 42, at the time of a heating operation, receives a supply of high temperature engine cooling water from the heating system 3 (to be explained later), and heats the introduced air that has been sent from the cooler unit 30.

The introduced air that has been sent to the heater unit 40, is divided corresponding to the opening of the air mixing damper 43A of the air mixing damper apparatus 43, into air which is passed through the heater core 42 and heated, and air 5 which does not pass through the heater core 42.

The abovementioned defroster air outlet 44 discharges warmed and dehumidified air directly onto the inner surface of the windshield, in order to remove frost on the windshield before travelling during winter, or to remove fog on the 10 windshield while travelling in the rain. This air conditioning operation mode is called a defroster discharging mode. Furthermore, the face air outlet 45 discharges cold air towards the upper body of an occupant at the time of a cooling operation mainly in summer. This air conditioning operation mode is called a face discharging mode.

Furthermore, the foot air outlet 46 discharges warm air towards the feet of an occupant at the time of a heating operation mainly in winter, and this is called a foot discharging mode. There is also an air conditioning operation 20 mode called a bi-level discharging mode mainly used during the intermediate seasons of spring or autumn, which discharges air conditioned air from both the foot air outlet 45 and the face air outlet 46. In this case, as a general rule the air discharged from the face air outlet 45 is made a lower 25 temperature than that from the foot air outlet 46 so that the head is kept cool and the feet warm.

Next, the construction of the cooling system 2 will be

explained based on FIG. 5. The cooling system 2 supplies low temperature low pressure liquid refrigerant to the evaporator 31, and comprises; a compressor 51, a condenser 52, a receiver 53 (to be described later), and an expansion valve (omitted from the figure). In the case where the cooling system 2 does not require a cooling or dehumidifying function, provision thereof is omitted together with that of the evaporator 31. The compressor 51 compresses low temperature low pressure refrigerant which has absorbed heat from inside the vehicle interior at the evaporator 31 and evaporated, and discharges this as high temperature high pressure gas refrigerant to the condenser 52. In the case of an automotive air conditioner, the compressor 51 is driven by the engine 54 by way of a belt and clutch.

The condenser 52 is provided at the front of the engine room 6 for cooling the high temperature high pressure gas refrigerant supplied from the compressor 51 with outside air, to condense and liquefy the gas refrigerant. The liquefied gas refrigerant is then sent to the receiver 53 where the vapor is separated from the liquid, and the liquid is then sent to the expansion valve (omitted from the figure) as a high temperature high pressure liquid. At the expansion valve 53, the high temperature high pressure liquid refrigerant is reduced in pressure and expanded so as to give a low temperature low pressure liquid (mist) refrigerant, which is then supplied to the evaporator 31. Here the expansion valve is normally suitably provided at a location inside the cooler

unit 30 together with the evaporator 31.

Next is a brief description of the construction of the heating system 3 based on FIG. 5 and FIG. 6. The heating system 3 supplies high temperature engine cooling water serving as a heat source to the heater core 42, and introduces to the air conditioner, a part of the cooling water from the engine cooling water system which is circulated between the engine 54 and the radiator 55. This also performs flow control by means of a water valve 56.

Next is a brief description of the construction of the control section 4, base on FIG. 6. The control section 4 controls the operation of the air conditioning unit 1, the cooling system 2, and the heating system 3, constituting the air conditioner. Normally the control section 4 has built in control circuits in the operating panel 57 for performing various settings by the occupant, and is installed in a central portion of the instrument panel 7. The control section 4 is able to perform operations such as, the switching operation for the inlet air/outlet air switching damper 12, the selective switching of the various operating modes, the switching of the air flow quantity of the blower fan 21, and desired temperature setting operations.

Here, the air mixing damper 43 in the heater unit 40 will be explained. With respect to FIG. 1, the air mixing damper apparatus 43 comprises; a plate door type air mixing damper 43A for opening and closing the air introducing face 42a of the heater core 42, a rotation type lever 48 for the actuator

47 driving the air mixing damper 43A, and a rotation speed
adjustment mechanism for the air mixing damper 43A disposed
between the air mixing damper 43A and the lever 48, for
adjusting the rotation speed at an initial opening stage X and
5 a final opening stage Z of the air mixing damper 43A, to a
speed lower than at an intermediate opening stage Y.

Here, with the present embodiment, the range of the
opening of the air mixing damper 43A is from the fully closed
position up to around 15 degrees in the initial opening stage
10 X, while the range of the opening of the air mixing damper 43A
is from 20 degrees from the fully open position up to fully
open in the final opening stage Z. These ranges are ranges
where the temperature of the discharged air changes
sensitively, with respect to movement of the air mixing damper
15 43A. The air mixing damper 43A rotates about a shaft O1 axis,
from a fully closed position (FIG. 1) where the air
introducing face 42a of heater core 42 is closed so that the
cold air from the evaporator 31 does not pass through, to a
fully opened position (FIG. 16) where the air introducing face
20 42a of the heater core 42 is open allowing all of the cooling
air from the evaporator 31 to pass through.

The actuator 47 comprises an electric motor for rotating
about a shaft O2 axis (through a range of 100 degrees), and a
lever 48 linked to a temperature setting operating lever (not
25 shown) of the operating panel 57. A tip portion of the lever
48 is guided by an arc-shaped guide 63.

The rotation speed adjustment mechanism comprises; a cam

60 extending to the actuator 47 side and fixed to the shaft 01
of the air mixing damper 43A, and a pin 61 for engaging with
the cam 60, provided at the tip of the lever 48 of the
actuator 47. The cam 60 has an opening portion 62 with a
5 guide path for guiding the pin 61 of the lever 48 of the
actuator 47 provided around the periphery thereof. The guide
path has a first guide path K1 for effecting control at the
initial opening stage X of the air mixing damper 43A, a second
guide path K2 for effecting control at the intermediate
10 opening stage Y of the air mixing damper 43A, and a third
guide path K3 for effecting control at the final opening stage
Z of the air mixing damper 43A.

The first guide path K1, as shown in FIG. 1, is formed in
a direction gradually separating outward with respect to a
15 turning path R of the pin 61 of the lever 48 of the actuator
47, in a fully closed position of the air mixing damper 43A,
and the third guide path K3, as shown in FIG. 16, is formed in
a direction gradually separating outward with respect to the
turning path R of the pin 61 of the lever 48 of the actuator
20 47, in a fully open position of the air mixing damper 43A.

Accordingly, the opening portion 62 is formed in an
approximate λ shape by the first guide path K1, the second
guide path K2, and the third guide path K3.

The air mixing damper 43A is provided with a coil spring
25 64 as an urging device for urging the pin 61 of the lever 48
of the actuator 47 into the first guide path K1 at least at an
initial opening stage X of the air mixing damper 43A, and

urging the pin 61 of the lever 48 of the actuator 47 into the third guide path K3 at least at a final opening stage Z of the air mixing damper 43A. The coil spring 64 is shown only in FIG. 1, FIG. 12 and FIG. 16. In FIG. 12 the air mixing damper 43A is urged slightly in the clockwise direction.

Consequently, with the air mixing damper apparatus 43, while the lever 48 of the actuator 47 rotates at a uniform speed from 0 degrees to as far as 100 degrees, the air mixing damper 43A rotates at varying speeds within the range from the fully closed position to the fully opened position (rotation angle approximately 100 degrees). Specifically, this is described in FIG. 1 though FIG. 7 showing the positions for lever arm 48 rotation angles from 0 degrees through to 10 degrees respectively, and furthermore in FIG. 8 through FIG. 16 (100 degrees) showing the respective states as the rotation angle increases in 10 degrees amounts.

In the ranges shown in FIG. 1 and FIG. 7 through FIG. 9, the lever 48 of the actuator 47 rotates 30 degrees, and during this time the air mixing damper 43A rotates slowly within a small rotation angle range being the initial opening stage X (refer to the low incline range of FIG. 2). This is because the shape of the first guide path K1 of the cam 60, in the fully closed position in FIG. 1, is formed in a direction gradually separating outward with respect to the turning path R of the pin 61 of the lever 48. Hence at the initial opening stage X, the retraction amount of the air mixing damper 43A is small with respect of the rotation angle of the lever 48.

Consequently, during this time the air mixing damper 43A opens slowly. Therefore in the initial opening stage X of the air mixing damper 43A being the stage where the temperature of the discharged air changes sensitively, it is possible to set 5 an appropriate position of the air mixing damper 43A in order to obtain a temperature of the discharged air corresponding to the lever operation by an occupant. Furthermore, it is possible to make the occupant feel that the movement of the operating lever by the occupant corresponds to the actual 10 temperature change. Here, in the initial opening stage X, as shown in FIG. 8 and FIG. 9 an unconstrained state of the pin 61 occurs. However, since the coil spring 64 urges the pin 61 into the first guide path K1, the air mixing damper 43A is positively maintained so that the air mixing damper 43A does not swing.

In the ranges shown in FIG. 9 through FIG. 13, the lever 48 of the actuator 47 rotates from 30 degrees to 70 degrees, during which time the air mixing damper 43A rotates quickly within the angle range of the intermediate opening stage Y 20 (refer to the steep range in FIG. 2). This is because the second guide path K2 of the cam 60 is shaped in the form of the letter 'V', and as shown in FIG. 10 and FIG. 11, it moves the air mixing damper 43A with the same retraction amount as the movement amount of the pin 61 of the lever 48.

Consequently, during this time the air mixing damper 43A 25 opens quickly at a wide angle. Therefore at the intermediate opening stage Y of the air mixing damper 43A being the stage

- where the temperature of the discharged air changes slowly, it is possible to set an appropriate position of the air mixing damper 43A in order to obtain a temperature of the discharged air corresponding to the lever operation by an occupant.
- 5 Furthermore, it is possible to make the occupant feel that the movement of the operating lever by the occupant corresponds to the actual temperature change. The pin 61 not separating from the second guide path K2 as a result of the coil spring 64, is the same as in the case of the initial opening stage X.

In the ranges shown in FIG. 13 through FIG. 16, the lever 48 of the actuator 47 rotates from 70 degrees through to 100 degrees, and during this time the air mixing damper 43A rotates slowly within a small rotation angle range being the final opening stage Z (refer to the low incline range of FIG. 2). This is because the shape of the third guide path K3 of the cam 60, in the fully open position in FIG. 16, is formed in a direction gradually separating outward with respect to the turning path R of the pin 61 of the lever 48. Hence at the final opening stage Z, the degree of opening of the air 20 mixing damper 43A is small with respect of the rotation angle of the lever 48.

Consequently, this time the air mixing damper 43A opens slowly. Therefore as with the beforementioned case of the initial opening stage X, in the final opening stage Z of the 25 air mixing damper 43A being the stage where the temperature of the discharged air changes sensitively, it is possible to set an appropriate position of the air mixing damper 43A in order

to obtain a temperature of the discharged air corresponding to the lever operation by an occupant. Furthermore, it is possible to make the occupant feel that the movement of the operating lever by the occupant corresponds to the actual 5 temperature change. Here, in the final opening stage Z, as shown in FIG. 13 an unconstrained state of the pin 61 occurs. However, since the coil spring 64 urges the pin 61 into the third guide path K3, the air mixing damper 43A is positively maintained so that the air mixing damper 43A does not swing.

Consequently, the rotation for the air mixing damper 43A is such that the change amount in the opening as shown in FIG. 2 is not the same as the rotation of the actuator 47, namely does not correspond to the operation of the lever L on the operating panel 57 by an occupant. Hence due to this, the variation in temperature of the discharged air (FIG. 17) as happens conventionally in the case where the change amount of the opening of the air mixing damper 43A is constant with respect to the rotation for the air mixing damper 43A, can be made linear. Furthermore, it is possible to set the 20 temperature of the discharged air corresponding to the amount of operation of the lever L (operating means) on the operating panel 57 by the occupant. Hence, it is possible to improve the operation of an air conditioning apparatus for vehicles. In other words, the amount of rotation of the air mixing 25 damper 43A with respect to the amount of operation of the lever L on the operating panel 57 changes from the time when the lever L starts to operate to when its operation is

completed. More specifically, the amount of rotation of the air mixing damper 43A with respect to the operation of the lever L on the operating panel 57 at the time when the operation starts and when operation is being completed is less compared to the time when operation is under-way, and as a result it is possible to obtain an ideal discharge temperature, as shown in FIG. 3.

Furthermore, because the operation of the air mixing damper 43A is controlled with a simple cam 60 and pin construction, it is possible to achieve a reduction in costs compared to the case with control on the actuator side.

The present invention is not to be limited to the aforementioned embodiments, and for example, it is acceptable to eliminate the coil spring 64 by making the cam a rotation cam with the first guide path, the second guide path and the third guide path connected in a curved shape. Furthermore, because the initial opening stage X, the intermediate opening stage Y, and the final opening stage Z change due to of various factors such as the configuration of the air conditioning unit 1, the invention also includes cases with openings of the air mixing damper 43A other than those shown.

INDUSTRIAL APPLICABILITY

As described above, with the air mixing damper apparatus of the first aspect of the present invention, the temperature of the discharged air can be changed linearly with respect to

the operation of an actuator lever. Hence there is the effect that the opening and closing operation of the air mixing damper in accordance with the intention of the operator can be realized.

With the air mixing damper apparatus of the second aspect of the present invention, it is possible to lower the change amount with respect to the movement of the actuator lever at the initial opening stage and the final opening stage of the air mixing damper, to less than at the intermediate opening stage. Therefore at the initial opening stage and the final opening stage of the air mixing damper, the change in temperature of the discharged air corresponding to the opening of the air mixing damper can be made gentle. Consequently, there is the effect that the change in the temperature of the discharged air with respect to actuator lever movement through the period from the fully closed position to the fully open position of the air mixing damper can be made linear.

With the air mixing damper of the third aspect of the present invention, there is the effect that a positive operation can be ensured with a simple cam and pin construction, without the need to improve the actuator.

With the air mixing damper of the fourth aspect of the present invention, for example the first guide path, the second guide path, and the third guide path can be formed corresponding to the location part of the air mixing damper. Therefore there is the effect that the air mixing damper can be operated by positively moving in a predetermined manner

while the pin of the actuator lever is being guided along the respective guide paths.

With the air mixing damper of the fifth aspect of the present invention, for example the first guide path, the second guide path, and the third guide path can be formed corresponding to the location part of the air mixing damper. Therefore there is the effect that the air mixing damper can be operated by moving in a predetermined manner while the pin of the actuator lever is being guided along the respective guide paths constituting the periphery of the opening portion.

With air mixing damper of the sixth aspect of the present invention, in the initial opening stage of the air mixing damper, when the air mixing damper starts to open from a fully closed position, it is possible to operate in such a way that it opens gradually. Moreover, in the final opening stage of the air mixing damper, it is also possible to operate in such a way that it opens gradually during the interval between a near fully opened position and a fully opened position. Hence the rotation speed of the air mixing damper at the initial opening stage and the final opening stage can be made less than at the intermediate stage. Therefore at the initial opening stage and the final opening stage of the air mixing damper, the change in temperature of the discharged air corresponding to the opening of the air mixing damper can be made gentle. Consequently, there is the effect that the change in the temperature of the discharged air with respect to actuator lever movement through the period from the fully

closed position to the fully open position of the air mixing damper can be made linear.

With air mixing damper of the seventh aspect of the present invention, the pin of the actuator lever can be guided 5 in at least the first guide path and the third guide path. Therefore, the movement of the actuator can be positively transmitted to the air mixing damper.

With air mixing damper of the eighth aspect of the present invention, there is the effect that the change in the 10 temperature of the discharged air with respect to actuator lever movement through the period from the fully closed position to the fully open position of the air mixing damper can be made linear.

With the air conditioning apparatus for vehicles of the 15 ninth aspect of the present invention, there is the effect that the temperature of the discharged air can be linearly changed in accordance with the operation by an occupant of temperature adjustment of the discharged air. Therefore there 20 is the effect that conditioned air matching the operation of temperature adjustment can be realized.

With air mixing damper of the tenth aspect of the present invention, there is the effect that the change in the 25 temperature of the discharged air with respect to the operation by an occupant of temperature adjustment of the discharged air can be made constant.

With air mixing damper of the eleventh aspect of the present invention, there is the effect that the temperature of

the discharged air can be linearly changed with respect to the operation by an occupant of temperature adjustment of the discharged air.

CLAIMS

1. An air mixing damper apparatus (43) characterized in that there is provided between a plate door type air mixing damper (43A) for opening and closing an air introducing face (42a) of a heater core (42), and a rotation type lever (48) of an actuator (47) for driving the air mixing damper (43A), a mechanism for adjusting rotational speed of the air mixing damper (43A) to linearly change the temperature of discharged air with respect to the operation of the lever of the actuator (47).
2. An air mixing damper apparatus (43) characterized in that there is provided between a plate door type air mixing damper (43A) for opening and closing an air introducing face (42a) of a heater core (42), and a rotation type lever (48) of an actuator (47) for driving the air mixing damper (43A), a mechanism for adjusting rotational speed at an initial opening stage (X) and a final opening stage (Z) of the air mixing 20 damper 43A, to a speed lower than at an intermediate opening stage (Y).
3. An air mixing damper apparatus (43) according to either one of claim 1 and claim 2, characterized in that said 25 mechanism for adjusting rotational speed comprises; a cam (60) provided in the air mixing damper (43A) and a pin (61)

provided on the lever (48) of the actuator (47) for engaging with said cam (60).

4. An air mixing damper apparatus (43) according to claim 3,
5 characterized in that said cam (60) incorporates a guide path for guiding the pin (61) of the lever (48) of the actuator (47), and the guide path has a first guide path (K1) for effecting control at an initial opening stage (X) of the air mixing damper (43A), a second guide path (K2) for effecting control at an intermediate opening stage (Y) of the air mixing damper (43A), and a third guide path (K3) for effecting control at a final opening stage (Z) of the air mixing damper (43A).

10 5. An air mixing damper apparatus according to claim 3,
characterized in that said cam (60) has an opening portion
(62) with a guide path for guiding the pin (61) of the lever
(48) of the actuator (47) provided around the periphery
thereof, and the guide path has a first guide path (K1) for
20 effecting control at an initial opening stage (X) of the air
mixing damper (43A), a second guide path (K2) for effecting
control at an intermediate opening stage (Y) of the air mixing
damper (43A), and a third guide path (K3) for effecting
control at a final opening stage (Z) of the air mixing damper
25 (43A).

6. An air mixing damper apparatus (43) according to either one of claim 4 and claim 5, characterized in that said first guide path (K1) is formed in a direction gradually separating outward with respect to a turning path of the pin (61) of the lever (48) of the actuator (47), in a fully closed position of the air mixing damper (43A), and said third guide path (K3) is formed in a direction gradually separating outward with respect to the turning path of the pin (61) of the lever (48) of the actuator (47), in a fully open position of the air mixing damper (43A).

10

15

20

25

30

35

40

45

50

55

60

65

70

75

80

85

90

95

100

105

110

115

120

125

130

135

140

145

150

155

160

165

170

175

180

185

190

195

200

205

210

215

220

225

230

235

240

245

250

255

260

265

270

275

280

285

290

295

300

305

310

315

320

325

330

335

340

345

350

355

360

365

370

375

380

385

390

395

400

405

410

415

420

425

430

435

440

445

450

455

460

465

470

475

480

485

490

495

500

505

510

515

520

525

530

535

540

545

550

555

560

565

570

575

580

585

590

595

600

605

610

615

620

625

630

635

640

645

650

655

660

665

670

675

680

685

690

695

700

705

710

715

720

725

730

735

740

745

750

755

760

765

770

775

780

785

790

795

800

805

810

815

820

825

830

835

840

845

850

855

860

865

870

875

880

885

890

895

900

905

910

915

920

925

930

935

940

945

950

955

960

965

970

975

980

985

990

995

1000

1005

1010

1015

1020

1025

1030

1035

1040

1045

1050

1055

1060

1065

1070

1075

1080

1085

1090

1095

1100

1105

1110

1115

1120

1125

1130

1135

1140

1145

1150

1155

1160

1165

1170

1175

1180

1185

1190

1195

1200

1205

1210

1215

1220

1225

1230

1235

1240

1245

1250

1255

1260

1265

1270

1275

1280

1285

1290

1295

1300

1305

1310

1315

1320

1325

1330

1335

1340

1345

1350

1355

1360

1365

1370

1375

1380

1385

1390

1395

1400

1405

1410

1415

1420

1425

1430

1435

1440

1445

1450

1455

1460

1465

1470

1475

1480

1485

1490

1495

1500

1505

1510

1515

1520

1525

1530

1535

1540

1545

1550

1555

1560

1565

1570

1575

1580

1585

1590

1595

1600

1605

1610

1615

1620

1625

1630

1635

1640

1645

1650

1655

1660

1665

1670

1675

1680

1685

1690

1695

1700

1705

1710

1715

1720

1725

1730

1735

1740

1745

1750

1755

1760

1765

1770

1775

1780

1785

1790

1795

1800

1805

1810

1815

1820

1825

1830

1835

9. An air conditioning apparatus for vehicles having an air conditioning unit (1) provided with:
- an inside air/outside air box (10) incorporating an
- 5 inside/outside air switching damper (12) for opening an outside air introducing inlet (11b) and an inside air introducing inlet (11a) to selectively switch introduced air to one of inside air and outside air,
- a blower unit (20) having a blower fan (21) for blowing
- 10 the introduced air,
- a cooler unit (30) fitted with an evaporator (31) for exchanging heat between a refrigerant and said introduced air passing therethrough, and
- a heater unit (40) having a heater core (42) provided
- 15 inside a heater unit case for heating the introduced air passing therein, an air mixing damper apparatus (43) for adjusting the flow quantity of said introduced air which passes through said heater core (42), and a plurality of air outlets (44, 45, 46) opening from said heater unit case (41)
- 20 and respectively provided with dampers (44a, 45a, 46a), characterized in that said air mixing damper apparatus (43) is an air mixing damper apparatus (43) according to any one of claim 1 through claim 8.
- 25 10. An air mixing damper apparatus (43) provided with a plate door type air mixing damper (43A) for opening and closing an air introducing face (42a) of a heater core (42), and

operating means (L) for specifying an operating amount of the air mixing damper (43A), characterized in that an operating amount of said air mixing damper (43A) with respect to an operating amount of said operating means (L) changes from 5 operation initiation to operation completion.

11. An air mixing damper apparatus (43) according to claim 10, characterized in that an operating amount of said air mixing damper (43A) with respect to an operating amount of said operating means (L) at operation initiation and operation completion is small compared to at an intermediate operation stage.

TOP SECRET//
REF ID: A65740

ABSTRACT

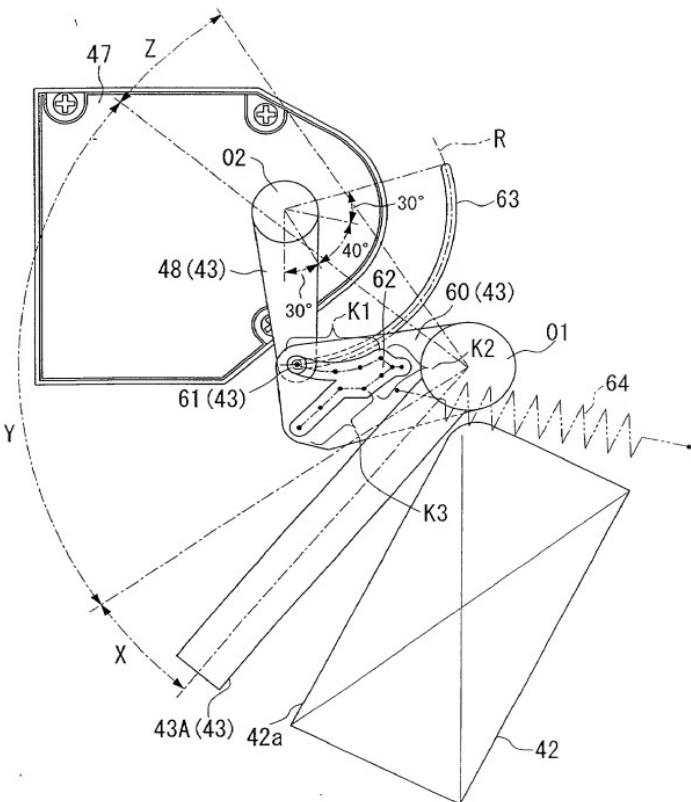
The invention provides an air mixing damper apparatus and an air conditioning apparatus for vehicles where the
5 temperature of discharged air can be changed linearly with respect to the operation of an actuator lever. A rotation speed adjustment mechanism is disposed between a plate door type air mixing damper 43A for opening and closing an air introducing face 42a of a heater core 42, and a rotation type lever 48 for an actuator 47 driving the air mixing damper 43A, for adjusting the rotation speed at an initial opening stage X and a final opening stage Z of the air mixing damper 43A, to a speed lower than at an intermediate opening stage Y.

PENTON & SONS INC.

09/719538

OBLON ET AL (703) 413-3000
DOCKET # 200719US3POT SHEET 1 OF 16

FIG. 1



TOEYGO-SCE55T460

OBLON ET AL (703) 413-3000
DOCKET # 200719US3POT SHEET 2 OF 16

FIG. 2

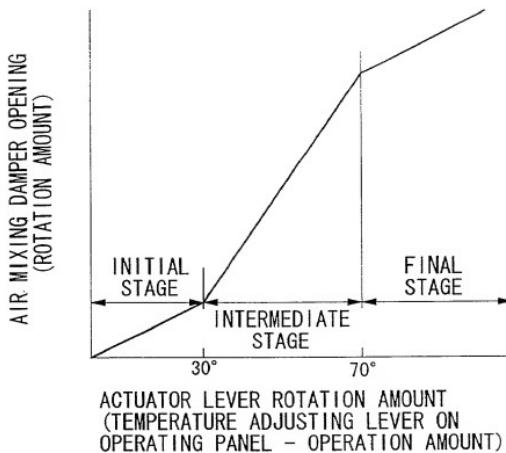
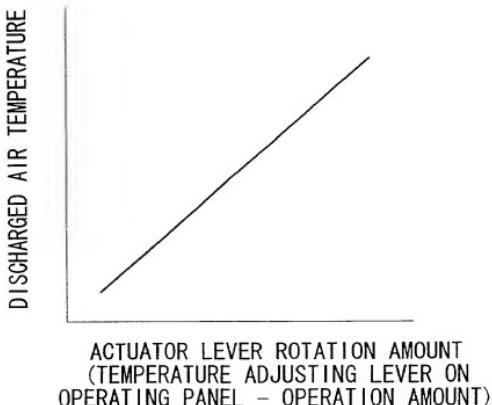


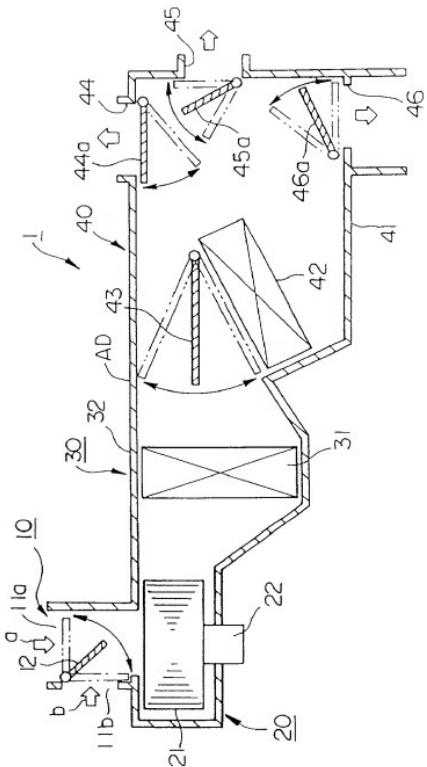
FIG. 3



09/719538

OBLON ET AL (703) 413-3000
DOCKET # 200719US3PCT SHEET 3 OF 16

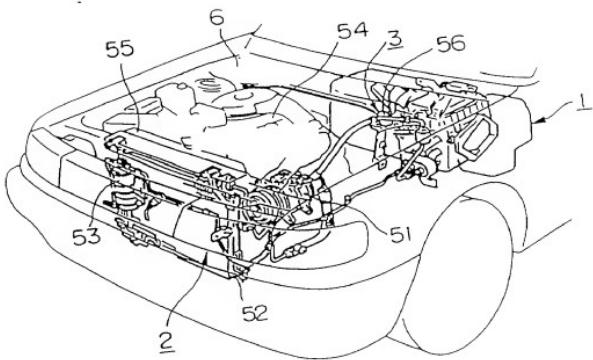
FIG. 4



09/719538

DOBLOM ET AL (703) 413-3000
DRAFT # 200719US3POT SHEET 4 OF 16

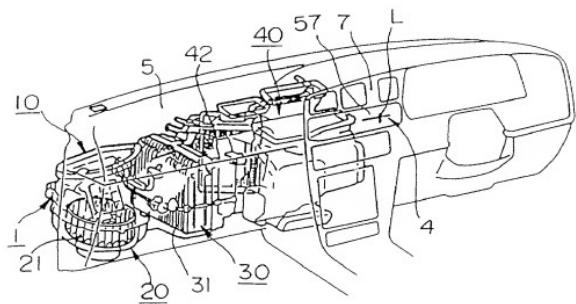
FIG. 5



09/719538

OBLON ET AL (703) 413-3000
DOCKET # 300719US3P0T SHEET 5 OF 16

FIG. 6

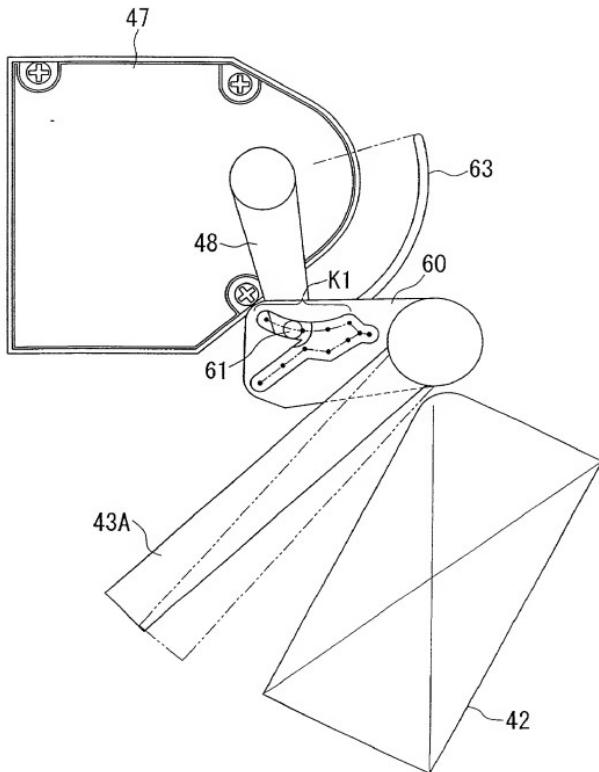


100CT90-08561760

09/719538

OBLON ET AL (703) 413-3000
DOCKET # 2007AUSPCT SHEET 6 OF 16

FIG. 7

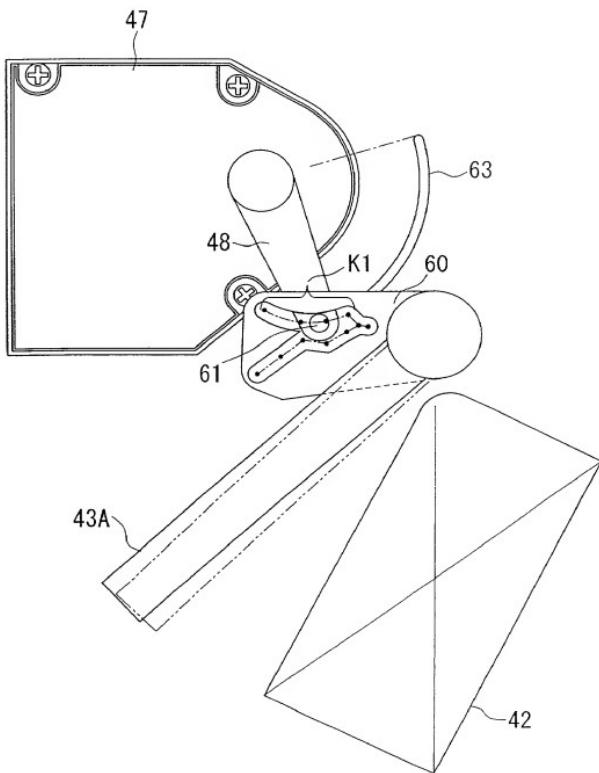


TOEY00-BCE56T460

09/719538

OBLOON ET AL (703) 413-3000
DOCKET # 200719US3P01 SHEET 7 OF 16

FIG. 8

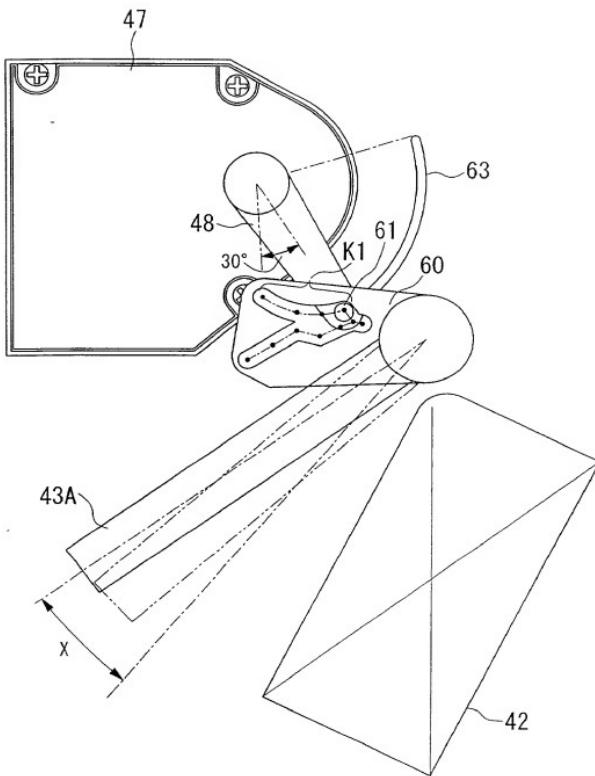


1002190 • 86561260

09/719536

OBLON ET AL (703) 413-3000
DOCKET # 200719US3PCT SHEET 8 OF 16

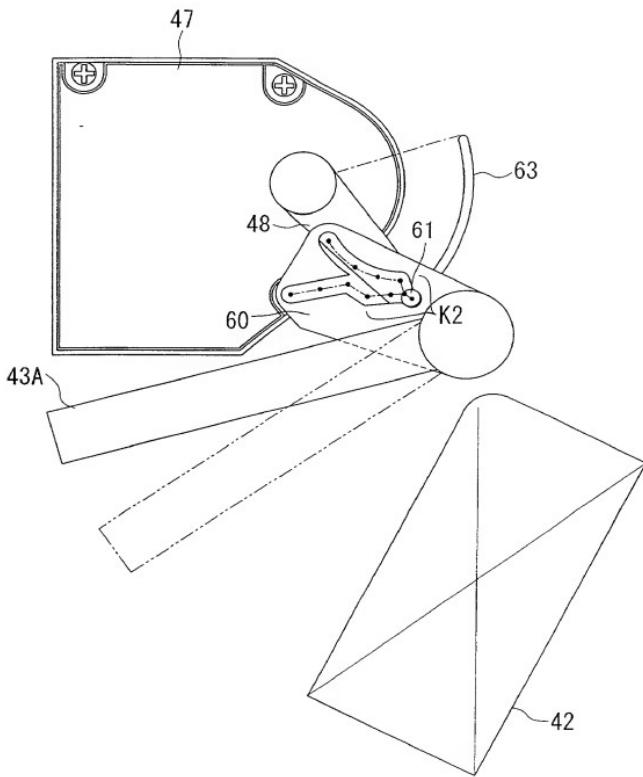
FIG. 9



09/719538

OBLOON ET AL (703) 413-3000
DOCKET # SHEET 9 OF 16
200719US3PCT

FIG. 10

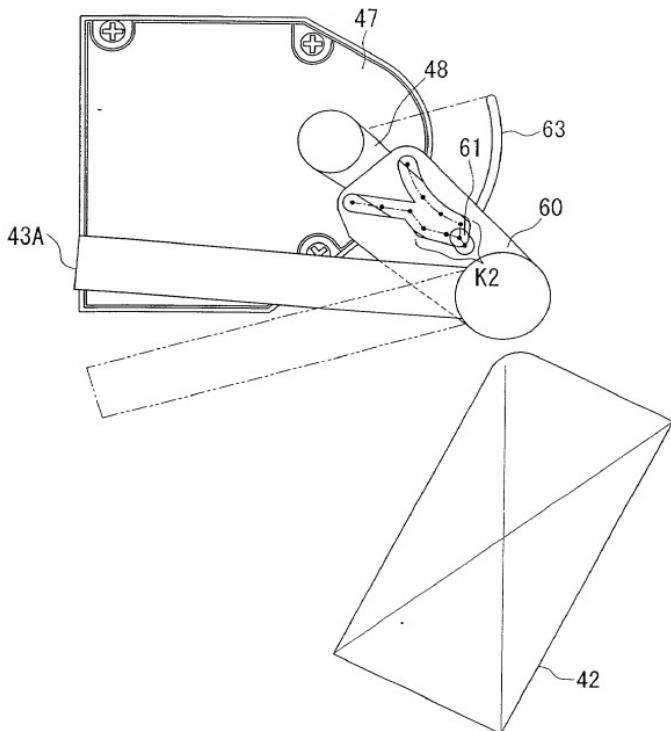


200719US3PCT 09/719538

09/719558

OBLON ET AL (703) 413-3000
DOCKET # 2007194US3PCT SHEET 10 OF 16

FIG. 11

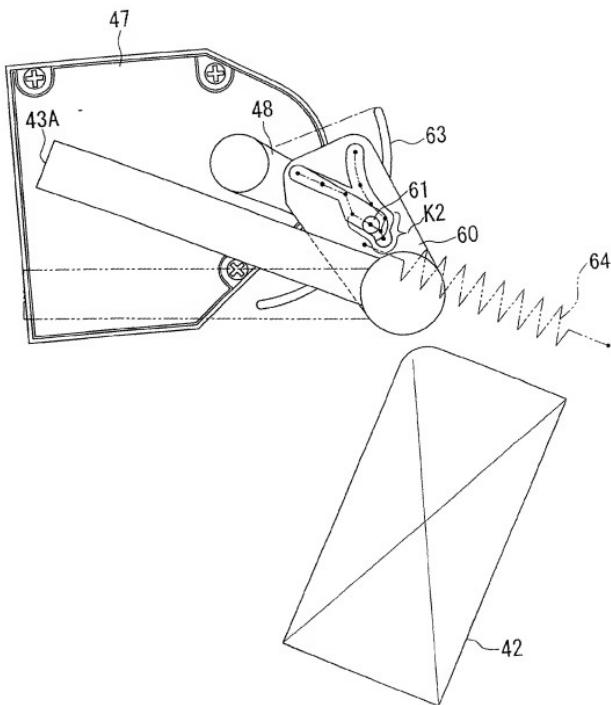


102700-00567460

09/719538

OBLON ET AL (703) 413-3000
DOCKET # SHEET 11 OF 16
2007194US3PCT

FIG. 12

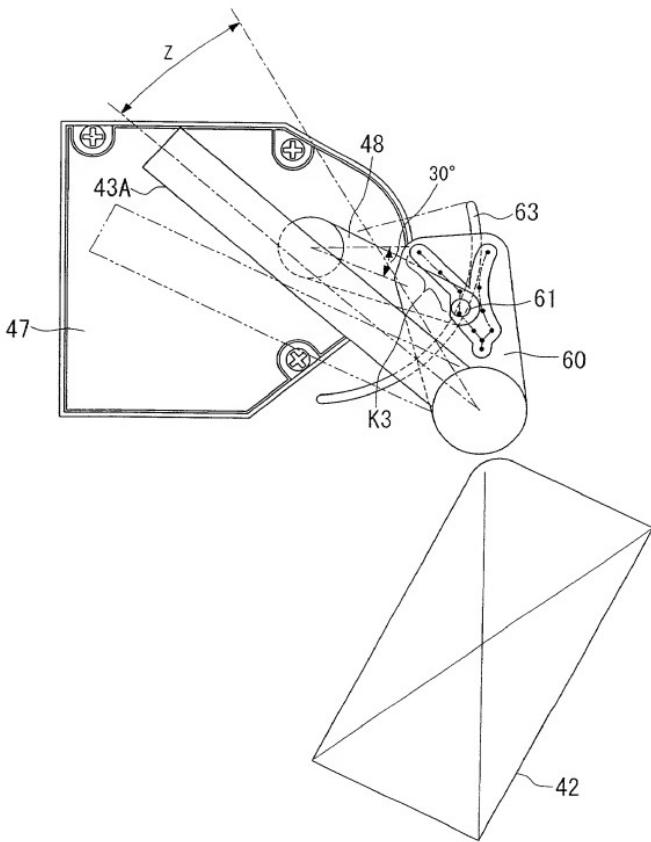


2025 RELEASE UNDER E.O. 14176

09/719538

OBLON ET AL (703) 413-3000
DOCKET # 200719US3POT SHEET 12 OF 16

FIG. 13

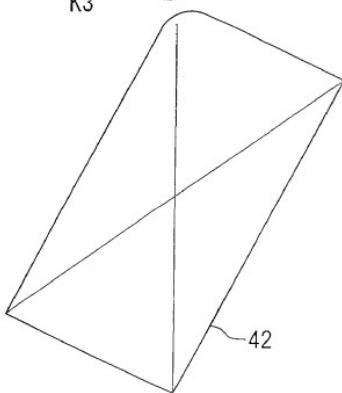
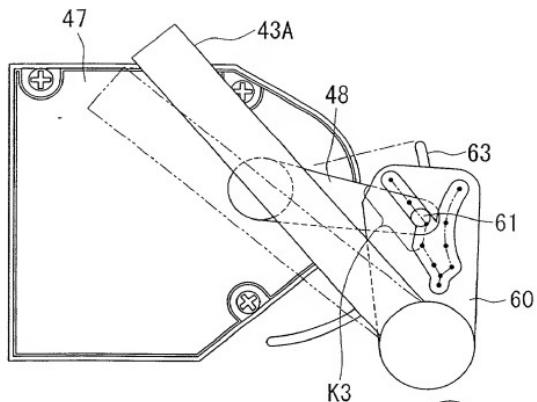


-FOOTER001-BE567460

09/719538

OBLON ET AL (703) 413-300
DOCKET # 200719US3POT SHEET 13 OF 16

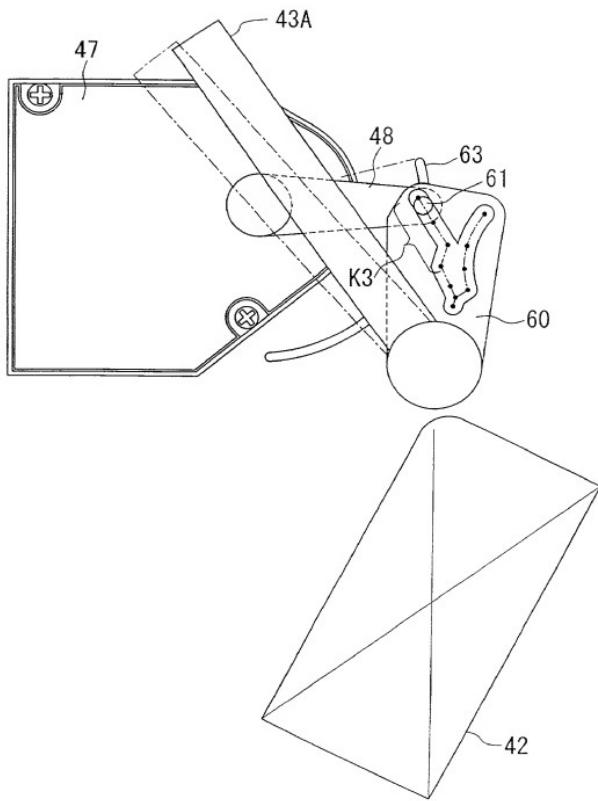
FIG. 14



09/719536

OBLON ET AL (703) 413-3006
ROCKEFELLER
200719US38CT SHEET 14 OF 16

FIG. 15

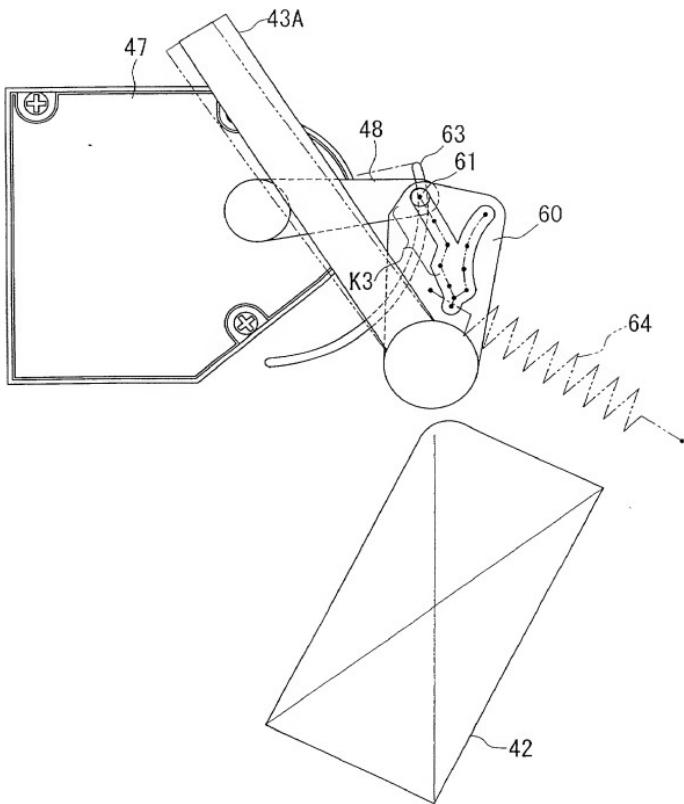


RECEIVED 2023 MAR 26 2023

09/719538

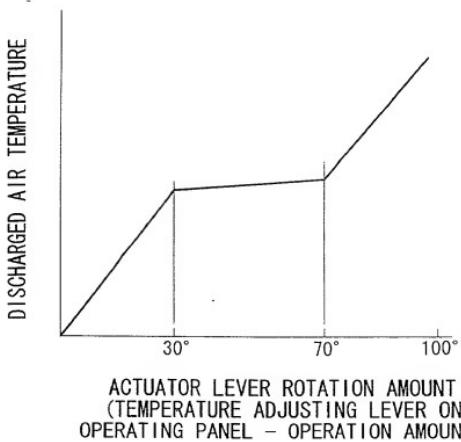
OBLON ET AL (703) 413-3000
DOCKET # 2007194US3POT SHEET 15 OF 16

FIG. 16



TOEYTB-BESTRZ60

FIG. 17



Declaration, Power Of Attorney and Petition

Page 1 of 3

WE (I) the undersigned inventor(s), hereby declare(s) that:

My residence, post office address and citizenship are as stated below next to my name,

We (I) believe that we are (I am) the original, first, and joint (sole) inventor(s) of the subject matter which is claimed and for which a patent is sought on the invention entitled

AIR MIXING DAMPER APPARATUS AND AIR CONDITIONING APPARATUS FOR VEHICLES

the specification of which

- is attached hereto.
- was filed on _____ as
Application Serial No. _____
and amended on _____.
- was filed as PCT international application
Number _____
on April 10, 2000
and was amended under PCT Article 19
on _____ (if applicable).

We (I) hereby state that we (I) have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

We (I) acknowledge the duty to disclose information known to be material to the patentability of this application as defined in Section 1.56 of Title 37 Code of Federal Regulations.

We (I) hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed. Prior Foreign Application(s)

Application No.	Country	Day/Month/Year	Priority Claimed
Patent 11-110141	Japan	16/04/1999	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No
_____	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No

2000-026

OSP - 10129
中國專利局
Page 2 of 3

Declaration

We (I) hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

(Application Number)	(Filing Date)
(Application Number)	(Filing Date)

* We (I) hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

Application Serial No.	Filing Date	Status (pending, patented, abandoned)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

30 And we (I) hereby appoint: Norman F. Oblon, Reg. No. 24,618; Marvin J. Spivak, Reg. No. 24,913; C. Irvin McClelland, Reg. No. 21,124; Gregory J. Maier, Reg. No. 25,592; Arthur I. Neustadt, Reg. No. 24,854; Richard D. Kelly, Reg. No. 27,757; James D. Hamilton, Reg. No. 28,421; Eckhard H. Kuesters, Reg. No. 28,870; Robert T. Pous, Reg. No. 29,099; Charles L. Gholtz, Reg. No. 26,395; Vincent J. Sunderdick, Reg. No. 29,004; William E. Beaumont, Reg. No. 30,996; Robert F. Gnuse, Reg. No. 27,295; Jean Paul Lavallee, Reg. No. 31,451; Stephen G. Baxter, Reg. No. 32,884; Martin M. Zoltick, Reg. No. 35,745; Robert W. Hahl, Reg. No. 33,893; Richard L. Treanor, Reg. No. 36,379; Steven P. Weihrouch, Reg. No. 32,829; John T. Goolkasian, Reg. No. 26,142; Richard L. Chinn, Reg. No. 34,305; Steven E. Lipman, Reg. No. 30,011; Carl E. Schlier, Reg. No. 34,426; James J. Kulbaski, Reg. No. 34,648; Richard A. Neifeld, Reg. No. 35,299; J. Derek Mason, Reg. No. 35,270; Surinder Sachar, Reg. No. 34,423; Christina M. Gadiano, Reg. No. 37,628; Jeffrey B. McIntyre, Reg. No. 36,867; and Paul E. Rauch, Reg. No. 38,591; our (my) attorneys, with full powers of substitution and revocation, to prosecute this application and to transact all business in the Patent Office connected therewith; and we (I) hereby request that all correspondence regarding this application be sent to the firm of OBLON, SPIVAK, McCLELLAND, MAIER & NEUSTADT, P.C., whose Post Office Address is: Fourth Floor, 1755 Jefferson Davis Highway, Arlington, Virginia 22202.

We (I) declare that all statements made herein of our (my) own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Yoshihiro Hashizume
NAME OF FIRST SOLE INVENTOR

Yoshihiro Hashizume
Signature of Inventor

June 1, 2001

Date

Residence: Nishi-kasugai-gun, Japan
Japan
Citizen of: JPY
Post Office Address: c/o MITSUBISHI HEAVY INDUSTRIES, LTD., Air-Conditioning & Refrigeration Systems Headquarters, 1, Asahi-cho 3-chome, Nishi-biwajima-machi, Nishi-kasugai-gun, Aichi-ken, Japan

2000-026

OSP-10129
半島電機

Page 3 of 3
Declaration

2-2
Hideto Noyama

NAME OF SECOND JOINT INVENTOR

Hideto Noyama

Signature of Inventor

June 1, 2001

Date

Shiro Matsubara

NAME OF THIRD JOINT INVENTOR

S. Matsubara

Signature of Inventor

June 1, 2001

Date

NAME OF FOURTH JOINT INVENTOR

Signature of Inventor

Date

NAME OF FIFTH JOINT INVENTOR

Signature of Inventor

Date

Residence: Nishi-kasugai-gun, Japan

JPX

Citizen of: Japan

Post Office Address: c/o MITSUBISHI HEAVY INDUSTRIES

LTD., Air-Conditioning & Refrigeration Systems

Headquarters, 1, Asahi-cho 3-chome,

Nishi-biwajima-machi, Nishi-kasugai-gun,

Aichi-ken, Japan

Shiro Matsubara

NAME OF THIRD JOINT INVENTOR

S. Matsubara

Signature of Inventor

June 1, 2001

Date

Residence: Nishi-kasugai-gun, Japan

JPX

Citizen of: Japan

Post Office Address: c/o MITSUBISHI HEAVY

INDUSTRIES, LTD., Air-Conditioning &

Refrigeration Systems Headquarters,

1, Asahi-cho 3-chome, Nishi-biwajima-machi,

Nishi-kasugai-gun, Aichi-ken, Japan

Residence: _____

Citizen of: _____

Post Office Address: _____

Residence: _____

Citizen of: _____

Post Office Address: _____